SCALLOP FISHERIES IN SOUTHERN AUSTRALIA: MANAGING FOR STOCK RECOVERY

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Scallop fisheries in southern Australia are showing signs of stock recovery after a period of low abundance. The recovery has been sporadic and slow although large areas of the fishing grounds have been subject to little or no fishing for up to 5 years. New management strategies designed to encourage stock recovery and promote sustainable harvests in the future are in place. Management strategies and fishery monitoring programs are presented.

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There are 5 distinct commercial scallop fishing zones in southern Australia : Port Phillip Bay and Lakes Entrance in Victoria; the greater area of Bass Strait (known as the Central Zone), the 20 nautical mile zone around the north coast of Tasmania called the Tasmanian Zone, and the east coast of Tasmania (Fig.1). They are geographically distinct in terms of their historical catch and fleet dynamics. Management is under the control of 3 separate authorities; the Victorian and Tasmanian State Governments and the Commonwealth Government (Australian Fish Management Authority). Three different management strategies are operating.

The Bass Strait Scallop Consultative Committee (BSSCC) formed in 1991 to develop a rational management plan for scallop fisheries across Bass Strait. This was the second time in the fisheries' history that such a process had been attempted (Zacharin,1990, 1991). An earlier plan developed by the Bass Strait Task Force which recommended that the fisheries' jurisdiction be split between Victoria and Tasmania was not effectively implemented (Zacharin,1990). Fishermen and managers recognised that future harvesting strategies needed to be based on current biological knowledge of the species (in regard to reproductive maturity and growth rates), fleet dynamics and the need for economic efficiency. The committee drafted a management plan with 5 main objectives: 1, to control fishing effort to a level which is consistent with the current state of knowledge of scallop stocks; 2, to encourage investigation and modification of the most appropriate fishing equipment and fishing practices to improve catch efficiency and to minimise damage to the scallop beds; 3, to allow further scientific and other data to be collected so that management decisions can be based on a sound understanding of biological and operational characteristics of the fishery; 4, to allow an effective level of recruitment to the fishery by prohibiting the taking of scallops of <80mm with a view to allowing adult stocks to complete at least two major spawnings before harvest; and 5, to allow participants to maximise their return from harvesting the scallop resource. (Bass Strait Scallop Management Plan 1992, Commonwealth Fisheries Act 1991).

The resultant management strategy combines input and output controls to restrict the number of fishers; to prohibit the taking of small scallops; to control scallop landings and to provide a level of profitability to the fleet.

CONTROLS ON FISHING

In the past, both the States and the Commonwealth restricted fishing activities by imposing input controls, such as closed seasons, size limits and dredge restrictions. Over the past 4 years there has been a shift towards output controls as they are perceived to be more effective in managing catch and controlling quality, provided that the necessary level of monitoring and enforcement is present. A size limit of 80mm at widest diameter, however, still exists. The two main strategies of the new management plan for the Central Zone of Bass Strait are the ' 20% trashing rate' requirement and the 'two-spawnings' criterion. The 20 % trashing rate was designed as a yield optimisation strategy, through limiting the capture of, and minimising incidental mortality to small (<80mm at widest diameter) scallops. The 'two spawning' criterion is a parallel management requirement designed to allow scallops two

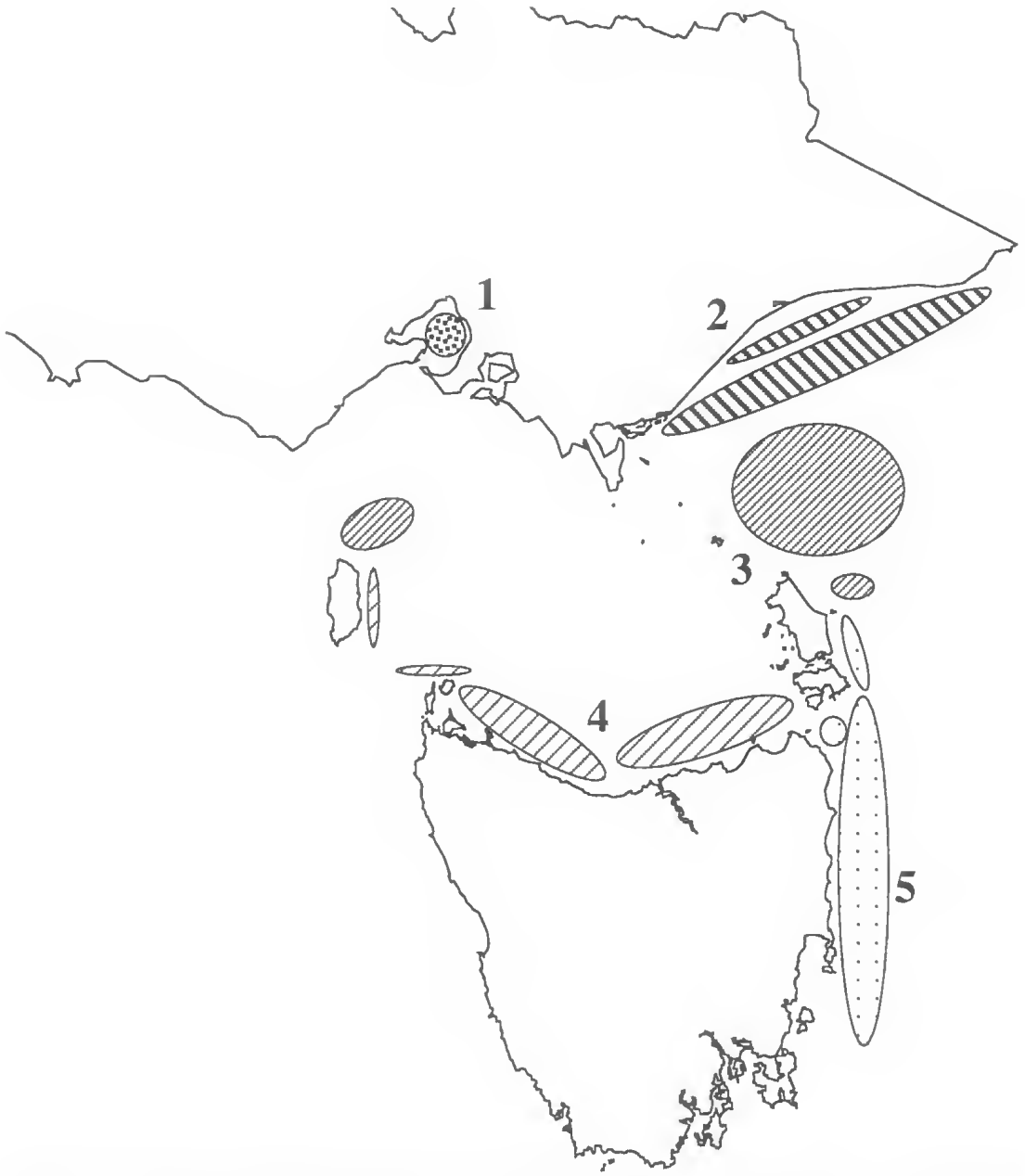

FIG.1. Southern Australian scallop fishery divided into 5 distinct zones. Port Phillip Bay (1), Lakes Entrance (2), Bass Strait (3), northern Tasmania (4), and eastern Tasmania (5).

major spawnings prior to their being fished, without regard to size. Thus scallops need both to have spawned twice and have less than 20% of the catch smaller than 80mm at widest diameter prior to their being fished.

The trashing rate is the proportion of small scallops discarded over a fishing ground during commercial operations. If more than 20% of the catch landed on the sorting tray is being returned to the water, fishermen are required to cease fishing in the area until scallop size increases. This is not difficult for the majority of Bass Strait scallop beds as they are usually of the one size or age class. However, in the event of two age

classes being mixed in the one area, a 20% trashing rate is considered acceptable, having regard for increasing mortality in the older age class, and the potential of predators to significantly reduce the remaining scallops on a fished bed.

Failure of fishermen to leave the area can result in a 3 month closure to the whole fishery. This closure can be implemented by the management committee under a specific provision in the Bass Strait scallop management plan.

Application of trashing rates are not new in shellfish management. A trashing rate of not more than 30% of landed catch was introduced into the eastern U.S offshore clam fishery in 1983. The reason was to prevent wastage due to excessive discarding and to meet minimum size requirements (Murawski & Serchuk, 1989).

Two major spawnings from adults, prior to their being fished, are considered essential if sufficient reproductive output from the fishery is to occur. Commercial scallops in Bass Strait have their first major spawning in their second year (1+ age class). However, fecundity is relatively low at this age(R. McLouglin pers. comm.) and therefore delaying the fishing until the scallops' second major spawning is desirable to increase the probability of some recruitment from that particular age class of adult spawners. Restricting fishing operations even further until a third major spawning has occurred cannot be defended, as natural mortality is thought to be high in Bass Strait populations after scallops reach an age of four years. High levels of predation by starfish on commercial scallop beds have been observed on a number of occasions.

Delaying the time of first capture till after the second spawning has a number of other benefits. Scallops have another year's growth, which results in the majority of the population reaching a shell height 70mm (shell width 80mm). Individual yields increase c.30%, and the landed value of the fishery should rise. There is an assumption that there is no rapid increase in natural mortality. A yield optimisation model needs to be completed to support this assumption.

The crux of the management plan is, if the trashing rate is below 20%, then it can be assumed that the bed should be fished until it is no longer economically viable to continue. After fishing scallops will still remain in the area but at a low density.

CATCH RESTRICTIONS

The Buss Strait fishery opens on 1 April of each year and closes in late December. This summer closure protects juveniles from dredge damage and stops scallops with poor meat condition being landed. In most years, post spawning meat and gonad condition does not improve until March. Scallop landings are subject to 'quota', set per trip or fortnightly. At present the quota is 150 units per fortnight; a unit being a black polypropylene onion bag measuring 900mm x 580mm and having a volume of 0.08 m^3. This measure owes its derivation to the past availability and suitability of onion bags for landing scallops.

While the fortnightly quota does reduce fishing effort to some extent, this is not its primary purpose. It is a marketing tool which provides for the landing of quality scallops and prevents wastage due to time delays in landing and processing larger volumes. It prevents a 'gold rush' event, as occurs when there is a competitive total allowable catch. The catch quota was agreed through negotiation between Government, fishermen and the processing sector. If costs of fishing rise and landed price falls or even remains steady, it is possible for the industry to re-negotiate the catch quota at any time. Profitability of the fleet is a main objective of the management plan.

Catch is also controlled in the Victorian and Tasmanian Zones. In Victoria a weekly catch limit is currently operating, while in Tasmania, a 'per trip' limit will continue to operate when fishing recommences in the future.

QUOTA MONITORING AND CATCH DATA

Each unit or bag landed must have a plastic colour-coded tag attached. Tags are issued each month in advance by the Australian Fish Management Authority. Unused tags are returned as a cost saving measure and are re-issued the following year but in a different month. Numerical coding also changes each month and year to ensure unused tags will not be held over from year to year. The tag system allows efficient monitoring and enforcement of the quota, and in providing a validation system for scallop landings through the processing sector.

A new logbook introduced in 1992 is based on a 7 x 7 nautical mile grid. Returns are filled out for each trip and data entered on a central computer database in Hobart. The system will give a better assessment of fleet dynamics, exploitation rates and total landed catch from the Central Zone. In the past the fleet has provided catch returns without meaningful spatial data to the State authority in which the vessel was based.

Consequently, no comprehensive analysis of the fishery has been possible. Victorian and Tasmanian fishery managers continue to collate their own catch returns from the inshore 20 nautical mile zones.

LICENSING

All 3 jurisdictional zones are limited entry fisheries and no new licences will be issued. There are 165 vessels licensed to fish in the Central Zone. Of these 73 are based in Tasmania and 92 in Victoria. Licences in Victoria are transferable and have been for the better part of the 30-year history of the fishery. In Tasmania, limited entry was not introduced until 1986 with transferability following in 1992 (Zacharin, 1990). Central Zone licences are still non-transferable pending the development of options for reducing the number of participants in the fishery. It is desirable that the issue of transferability be resolved, as Central Zone licences cannot be split from State scallop licences, which are transferable. It would be highly undesirable to create a 'third' scallop fleet in the Central Zone of Bass Strait. An important objective of the licensing policy is to have all the Central Zone licences held by the State scallop fleets, as the inshore scallop fishing grounds have historically provided the bulk of the scallop catch, with the Central Zone providing good catches intermittently.

FISHING GEAR

The southern scallop fishery uses tooth-bar steel box dredges 2–4.5m wide. Protruding teeth on the bars range from 2.5–15cm, depending on the type of bottom sediment and the individual operator. These dredges can cause high levels of incidental damage and alternative designs are still being investigated. Evidence from dredge trials shows that up to 50% of scallops in the dredge's path may be damaged, depending on the type of bottom, length of toothbar, density of scallops and fishing practices. Dredge efficiency can be low, having been experimentally measured at 10 % (McLoughlin *et al.*,1991). Gear technology improvements are important to this fishery as any reduction in incidental mortality and increases in efficiency will reduce costs and increase yields.

EFFECTIVENESS OF MANAGEMENT STRATEGIES

The new plan for the Central Zone has yet to be tested under rigorous fishing operations due to the low level of commercial fishing operations. Mechanisms such as at-sea monitoring and shore based market measurers will provide for a quick response to any problems that arise with regard to scallop size. The Victorian fishery has been operating under a tag system for two years and the scallop industry seems pleased with the progress of this system.

Any management plan for the southern scallop fishery should be complementary between Victorian and Tasmanian authorities. The new plan for the Central Zone goes a long way towards achieving this; however, further gains may be difficult because of the differences in fleet dynamics between the two States.

The Victorian scallop fishery has a single licensed fleet that is heavily depreciated and largely reliant on annual scallop fishing seasons. In Tasmania the multi-purpose fishing fleet has evolved with the majority of scallop licences being on vessels with rock lobster entitlements. Other Tasmanian scallop vessels are licensed to drop-line, trawl or take shark during a closed scallop season. These differences in dynamics between the Victorian and Tasmanian fleets have resulted in each having different economic constraints. The zoning of the Bass Strait scallop fishery needs to be retained to enable the subtle differences in management priorities to operate, as appropriate for each State's fishing industry.

RESEARCH AND DEVELOPMENT REQUIREMENTS

Six future research needs, identified for the southern scallop fishery by the Bass Strait Management Committee, are listed in order of priority: 1, confirmation that Bass Strait scallops consist of a single stock; 2, development of an efficient and reliable recruitment monitoring technique to provide an index of annual spatfall; 3, development of statistically reliable survey techniques for assessing biomass on individual beds; 4, assessment of the overall impact of predation by starfish (*Coscinasterias* sp.) on scallop populations; 5, investigation of recruitment enhancement/sea ranching of scallops as per the New Zealand model; and 6, investigation of differences in growth rates and fecundity schedules for scallops in different regions of Bass Strait (Bass Strait Scallop Management Committee 1992, *mimeo*).

The second priority is important in providing a measure of success of the management plan,

specifically the two-spawning criterion. A recruitment index also provides early warning of recruitment failure or 'above-average' recruitment success.

The impact of predatory starfish was demonstrated to be of considerable importance in 1992. An identified scallop bed east of Deal Island in Bass Strait was decimated by starfish during a delay to fishing, in an attempt to conform to the two-spawning criterion and improve scallop yields. Further investigation of these predators is necessary to prevent such an occurrence happening again.

PROGNOSIS FOR 1993 AND BEYOND

There has been a significant recovery of scallop stock(s) in both Port Phillip Bay and off Lakes Entrance in Victoria. A large settlement occurred in the spring of 1990 with subsequent recruitment to the fisheries in 1992. Further settlement has been observed in each of the following years and the fisheries are showing good prospects for the next one to two years (Zacharin - pers. obs.). It is ironic that the beds off Lakes Entrance (which have been sporadically fished) have recovered before the scallop grounds in Tasmania (where the fishery has been closed for five years). In this instance, total closure of the fishery has not lead to any earlier stock recovery than has been observed in Victorian waters, where fishing continued. However, there is no certainty that the factors affecting recruitment off Lakes Entrance apply over a much wider area, and no conclusions can be made in terms of management for stock recovery.

Recent exploratory excursions into the Central Zone and the northern Tasmanian Zone have shown that juvenile scallops are present over a wide area. If these juveniles successfully recruit into the fishery in 1993 and 1994, an economically viable fishery will again operate in the Tasmanian and Central Zones.

LESSONS TO BE LEARNT

The recovery of the Victorian scallop grounds, through what appears in Port Phillip Bay to be due to an enormous settlement event in 1991, is difficult to explain. The residual stock in the bay was apparently at an all time low at 19 million, but one of the largest recorded settlements has occurred. The estimated abundance is in excess of 800 million scallops (D. Molloy, pers. comm.). This is another example of the critical influence of environmental variables on successful spawning events, settlement and subsequent recruitment. Stock/recruit relationships of *P. fumatus* in southern Australia appear to be extremely noisy if they exist at all. These observations support the new strategy of allowing two major spawnings before harvesting, particularly in the offshore fisheries where retention of spat over scallop grounds will be more variable than in the enclosed environs of Port Phillip Bay.

It is important to remember that the scallop fleets of Victoria and Tasmania are different in terms of their level of capital investment, vessel specifications, fishing patterns and reliance on the scallop resource for income. No hard and fast management plan across the three existing zones will be successful in meeting both States' administrative and economic requirements. Complementary management plans that take account of these differences are preferable to continued friction between the two State based fleets. One needs to be aware that the majority of the historical catch has come from the state 20 nautical mile zones, the Central Zone resource being one of sporadic opportunity.

Change for its own sake can be a destructive policy. The success or otherwise of the current management plan operating in the southern scallop fishery should be assessed before major changes are contemplated. Feedback on the effects of the trashing rate and two spawning strategy will not be evident for two to three years. With the new logbook providing better spatial information on catch, an integrated catch database system and progression towards developing a recruitment index or forecasting system, management of the scallop resources in southern Australia can only improve.

The Australian Fish Management Authority will probably relinquish responsibility for the Bass Strait scallop fishery in 1994 and leave joint management to the Victorian and Tasmanian agencies. A jurisdictional line would be drawn for the purpose of monitoring and enforcement responsibilities. The existence of remaining Bass Strait permits for the Central Zone which are not attached to state scallop licences may impede this process.

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